Sunflower Army Ammunition Plant
De Soto
Johnson County
Kansas

HAER No. KS-3

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Department of the Interior
Washington, DC 20013-7127

HISTORIC AMERICAN ENGINEERING RECORD

Sunflower Army Ammunition Plant

KS-3

Location:	Near the Kansas River, about 3 miles south of De Soto, Kansas in Johnson County.
Date of Construction:	Established in 1942.
Owner:	Department of the Army
Significance:	One of six smokeless powder plants constructed during WWII, Sunflower AAP produced propellants for small arms, cannon, and rocket.
Historical Report Prepared by:	Robert Ferguson, 1984.
Prepared for Transmittal by:	Robie S. Lange, HABS/HAER, 1985.

EXECUTIVE SUMMARY

The Sunflower Army Ammunition Plant (SFAAP) is a government-owned, contractor-operated installation under the Army's Armament, Munitions and Chemical Command (AMCCOM). The plant is situated on 9,063 acres near the Kansas River, about three miles south of DeSoto, Kansas, between Kansas City and Lawrence. One of six very similar smokeless powder plants constructed between 1940 and 1945, the SFAAP produced small-arms, cannon, and rocket propellant during World War II. The plant was rehabilitated and reactivated during the Korean and Vietnam Wars. Major modernization construction projects undertaken since the Korean War include: mechanized facilities for rolling rocket propellant paste, developed at and still unique to SFAAP; continuous nitroglycerin production facilities; and the first nitroguanidine manufacturing plant in the United States, completed in 1983.

The SFAAP currently comprises approximately 1,200 buildings. Nearly 1,000 of these date from the original construction period, but because of subsequent modification, no World War II-era production lines remain intact.

There are no Category I or II historic properties at the SFAAP. The Roberts House (now called the Recreation Building, Building FH-3) is a Category III historic property because it is important as a local architectural landmark and as an intact example of an historic regional building style.

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PREFACE

This report presents the results of an historic properties survey of the Sunflower Army Ammunition Plant (SFAAP). Prepared for the United States Army Materiel Development and Readiness Command (DARCOM), the report is intended to assist the Army in bringing this installation into compliance with the National Historic Preservation Act of 1966 and its amendments, and related federal laws and regulations. To this end, the report focuses on the identification, evaluation, documentation, nomination, and preservation of historic properties at the SFAAP. Chapter 1 sets forth the survey's scope and methodology; Chapter 2 presents an architectural, historical, and technological overview of the installation and its properties; and Chapter 3 identifies significant properties by Army category and sets forth preservation recommendations. Illustrations and an annotated bibliography supplement the text.

This report is part of a program initiated through a memorandum of agreement between the National Park Service, Department of the Interior, and the U.S. Department of the Army. The program covers 74 DARCOM installations and has two components: 1) a survey of historic properties (districts, buildings, structures, and objects), and 2) the development of archaeological overviews. Stanley H. Fried, Chief, Real Estate Branch of Headquarters DARCOM, directed the program for the Army, and Dr. Robert J. Kapsch, Chief of the Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) directed the program for the National Park

Service. Sally Kress Tompkins was program manager, and Robie S. Lange was project manager for the historic properties survey. Technical assistance was provided by Donald C. Jackson.

Building Technology Incorporated acted as primary contractor to HABS/HAER for the historic properties survey. William A. Brenner was BTI's principal-in-charge and Dr. Larry D. Lankton was the chief technical consultant. Major subcontractors were the MacDonald and Mack Partnership and Jeffrey A. Hess. The author of this report was Robert Ferguson. The author would like to thank the many employees at the SFAAP who graciously assisted him in his research and field surveys. He especially acknowledges the help of the following individuals: on the government staff, Henry Graziul, Operations Review Officer, and Thomas Loushine, Security Officer; and on the Hercules, Inc., staff, Larry Green, Engineer, who guided the field survey, Shelby Chism, and Leo West.

The complete HABS/HAER documentation for this installation will be included in the HABS/HAER collections at the Library of Congress, Prints and Photographs Division, under the designation HAER No. KS-3.

Chapter 1

INTRODUCTION

SCOPE

This report is based on an historic properties survey conducted in November 1983 of all Army-owned properties located within the official boundaries of the Sunflower Army Ammunition Plant (SFAAP). The survey included the following tasks:

- Completion of documentary research on the history of the installation and its properties.

- Completion of a field inventory of all properties at the installation.

- Preparation of a combined architectural, historical, and technological overview for the installation.

- Evaluation of historic properties and development of recommendations for preservation of these properties.

Also completed as a part of the historic properties survey of the installation, but not included in this report, are HABS/HAER Inventory cards for 40 individual properties. These cards, which constitute HABS/HAER Documentation Level IV, will be provided to the Department of the

Army. Archival copies of the cards, with their accompanying photographic negatives, will be transmitted to the HABS/HAER collections at the Library of Congress.

The methodology used to complete these tasks is described in the following section of this report.

METHODOLOGY

1. Documentary Research

The SFAAP was constructed during 1942-1945 as a propellant production facility. Since several installations around the country were involved with similar operations, an evaluation of the SFAAP's historical significance requires a general understanding of the American wartime munitions industry. To identify relevant published sources, research was conducted in standard bibliographies of military history, engineering, and the applied sciences. Unpublished sources were identified by researching the historical and technical archives of the U.S. Army Armament, Munitions and Chemical Command (AMCCOM) at Rock Island Arsenal.[1] In addition to such industry-wide research, a concerted effort was made to locate published sources dealing specifically with the history and technology of the SFAAP. This site-specific research was conducted primarily at the AMCCOM Historical Office at Rock Island Arsenal; the Johnson County Public Libraries in DeSoto and Antioch; and the government and contractor archives at the SFAAP. The Kansas State Historic Preservation Office

(Kansas State Historical Society, Topeka) was also contacted forinformation on the architecture, history, and technology of the SFAAP, but provided no new data.

Army records used for the field inventory included current Real Property Inventory (RPI) printouts that listed all officially recorded buildings and structures by facility classification and date of construction; the installation's property record cards; base maps and photographs supplied by installation personnel; and installation master planning, archaeological, environmental assessment, and related reports and documents. A complete listing of this documentary material may be found in the bibliography.

2. Field Inventory

Architectural and technological field surveys were conducted in November 1983 by Robert Ferguson. Following general discussions with Henry Graziul, Operations Review Officer, and Thomas Loushine, Security Officer, the surveyor was provided with an escort for a general field survey of all exterior areas at the installation, with the exception of the Nitroguanidine Plant (see Appendix A). Larry Green of Hercules, Inc., served as escort for the survey.

Field inventory procedures were based on the HABS/HAER Guidelines for Inventories of Historic Buildings and Engineering and Industrial Structures.[2] All areas and properties were visually surveyed. Building locations and approximate dates of construction were noted

from the installation's property records and field-verified. Interior surveys were made of the major facilities to permit adequate evaluation of architectural features, building technology, and production equipment.

Field inventory forms were prepared for, and black and white 35 mm photographs taken of all buildings and structures through 1945 except basic utilitarian structures of no architectural, historical, or technological interest. When groups of similar ("prototypical") buildings were found, one field form was normally prepared to represent all buildings of that type. Field inventory forms were also completed for representative post-1945 buildings and structures.[3] Information collected on the field forms was later evaluated, condensed, and transferred to HABS/HAER Inventory cards.

3. Historical Overview

A combined architectural, historical, and technological overview was prepared from information developed from the documentary research and the field inventory. It was written in two parts: 1) an introductory description of the installation, and 2) a history of the installation by periods of development, beginning with pre-military land uses. Maps and photographs were selected to supplement the text as appropriate.

The objectives of the overview were to 1) establish the periods of major construction at the installation, 2) identify important events

and individuals associated with specific historic properties, 3) describe patterns and locations of historic property types, and 4) analyze specific building and industrial technologies employed at the installation.

4. Property Evaluation and Preservation Measures

Based on information developed in the historical overviews, properties were first evaluated for historical significance in accordance with the eligibility criteria for nomination to the National Register of Historic Places. These criteria require that eligible properties possess integrity of location, design, setting, materials, workmanship, feeling, and association, and that they meet one or more of the following:[4]

A. Are associated with events that have made a significant contribution to the broad patterns of our history.

B. Are associated with the lives of persons significant in the nation's past.

C. Embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction.

D. Have yielded, or may be likely to yield, information important in pre-history or history.

Properties thus evaluated were further assessed for placement in one of five Army historic property categories as described in Army Regulation 420-40:[5]

Category I	Properties of major importance
Category II	Properties of importance
Category III	Properties of minor importance
Category IV	Properties of little or no importance
Category V	Properties detrimental to the significance of adjacent historic properties.

Based on an extensive review of the architectural, historical, and technological resources identified on DARCOM installations nationwide, four criteria were developed to help determine the appropriate categorization level for each Army property. These criteria were used to assess the importance not only of properties of traditional historical interest, but also of the vast number of standardized or prototypical buildings, structures and production processes that were built and put into service during World War II, as well as of properties associated with many post-war technological achievements. The four criteria were often used in combination and are as follows:

1) Degree of importance as a work of architectural, engineering, or industrial design. This criterion took into account the

qualitative factors by which design is normally judged: artistic merit, workmanship, appropriate use of materials, and functionality.

2) Degree of rarity as a remaining example of a once widely used architectural, engineering, or industrial design or process. This criterion was applied primarily to the many standardized or prototypical DARCOM buildings, structures, or industrial processes. The more widespread or influential the design or process, the greater the importance of the remaining examples of the design or process was considered to be. This criterion was also used for non-military structures such as farmhouses and other once prevalent building types.

3) Degree of integrity or completeness. This criterion compared the current condition, appearance, and function of a building, structure, architectural assemblage, or industrial process to its original or most historically important condition, appearance, and function. Those properties that were highly intact were generally considered of greater importance than those that were not.

4) Degree of association with an important person, program, or event. This criterion was used to examine the relationship of a property to a famous personage, wartime project, or similar factor that lent the property special importance.

The majority of DARCOM properties were built just prior to or during World War II, and special attention was given to their evaluation. Those that still remain do not often possess individual importance, but collectively they represent the remnants of a vast construction undertaking whose architectural, historical, and technological importance needed to be assessed before their numbers diminished further. This assessment centered on an extensive review of the military construction of the 1940-1945 period, and its contribution to the history of World War II and the post-war Army landscape.

Because technology has advanced so rapidly since the war, post-World War II properties were also given attention. These properties were evaluated in terms of the nation's more recent accomplishments in weaponry, rocketry, electronics, and related technological and scientific endeavors. Thus the traditional definition of "historic" as a property 50 or more years old was not germane in the assessment of either World War II or post-war DARCOM buildings and structures; rather, the historic importance of all properties was evaluated as completely as possible regardless of age.

Property designations by category are expected to be useful for approximately ten years, after which all categorizations should be reviewed and updated.

Following this categorization procedure, Category I, II, and III historic properties were analyzed in terms of:

- Current structural condition and state of repair. This information was taken from the field inventory forms and photographs, and was often supplemented by rechecking with facilities engineering personnel.

- The nature of possible future adverse impacts to the property. This information was gathered from the installation's master planning documents and rechecked with facilities engineering personnel.

Based on the above considerations, the general preservation recommendations presented in Chapter 3 for Category I, II, and III historic properties were developed. Special preservation recommendations were created for individual properties as circumstances required.

5. Report Review

Prior to being completed in final form, this report was subjected to an in-house review by Building Technology Incorporated. It was then sent in draft to the subject installation for comment and clearance and, with its associated historical materials, to HABS/HAER staff for technical review. When the installation cleared the report, additional draft copies were sent to DARCOM, the appropriate State Historic Preservation Officer, and, when requested, to the archaeological contractor performing parallel work at the

installation. The report was revised based on all comments collected, then published in final form.

NOTES

1. The following bibliographies of published sources were consulted: Industrial Arts Index, 1938-1957; Applied Science and Technology Index, 1958-1980; Engineering Index, 1938-1983; Robin Higham, ed., A Guide to the Sources of United States Military History (Hamden, Conn.: Archon Books, 1975); John E. Jessup and Robert W. Coakley, A Guide to the Study and Use of Military History (Washington, D.C.: U.S. Government Printing Office, 1979); "Military Installations," Public Works History in the United States, eds., Suellen M. Hoy and Michael C. Robinson (Nashville: American Association for State and Local History, 1982), pp. 380-400. AMCCOM (formerly ARRCOM, or U.S. Army Armament Materiel Readiness Command) is the military agency responsible for supervising the operation of government-owned munititions plants; its headquarters are located at Rock Island Arsenal, Rock Island, Illinois. Although there is no comprehensive index to AMCCOM archival holdings, the agency's microfiche collection of unpublished reports is itemized in ARRCOM, Catalog of Common Sources, Fiscal Year 1983, 2 vols. (no pl.: Historical Office, AMCCOM, Rock Island Arsenal, n.d.).

2. Historic American Buildings Survey/Historic American Engineering Record, National Park Service, Guidelines for Inventories of Historic Buildings and Engineering and Industrial Structures (unpublished draft, 1982).

3. Representative post-World War II buildings and structures were defined as properties that were: (a) "representative" by virtue of construction type, architectural type, function, or a combination of these, (b) of obvious Category I, II, or III historic importance, or (c) prominent on the installation by virtue of size, location, or other distinctive feature.

4. National Park Service, How to Complete National Register Forms (Washington, D.C.: U.S. Government Printing Office, January 1977).

5. Army Regulation 420-40, Historic Preservation (Headquarters, U.S. Army: Washington, D.C., 15 April 1984).

Chapter 2

HISTORICAL OVERVIEW

BACKGROUND

The Sunflower Army Ammunition Plant (SFAAP) is a government-owned, contractor-operated installation located on a 9,063-acre site near the Kansas River, about three miles south of DeSoto, Kansas, between Kansas City and Lawrence (Figure 1). One of six very similar smokeless powder plants constructed between 1940 and 1945, the SFAAP produced propellants for small arms, cannon, and rockets during World War II. In response to increased demand, the rocket lines were expanded several times during this period. Following World War II, the plant produced ammonium nitrate liquor for two years before entering "standby" status.

The SFAAP was rehabilitated and reactivated in 1951 for the Korean War, and remained in production until 1960. This period saw the development of mechanized facilities for rolling solventless double-base rocket propellant paste.

Reactivated in 1965 to support the Vietnam War, the SFAAP entered a period of modernization and expansion that continues to the present. Facilities for continuous production of nitroglycerin were completed in 1971. Although active production stopped in that year, major construction since then has included new acid facilities, second-generation mechanized paste rolling units, and the first nitroguanidine manufacturing plant in the United States, completed in 1983.

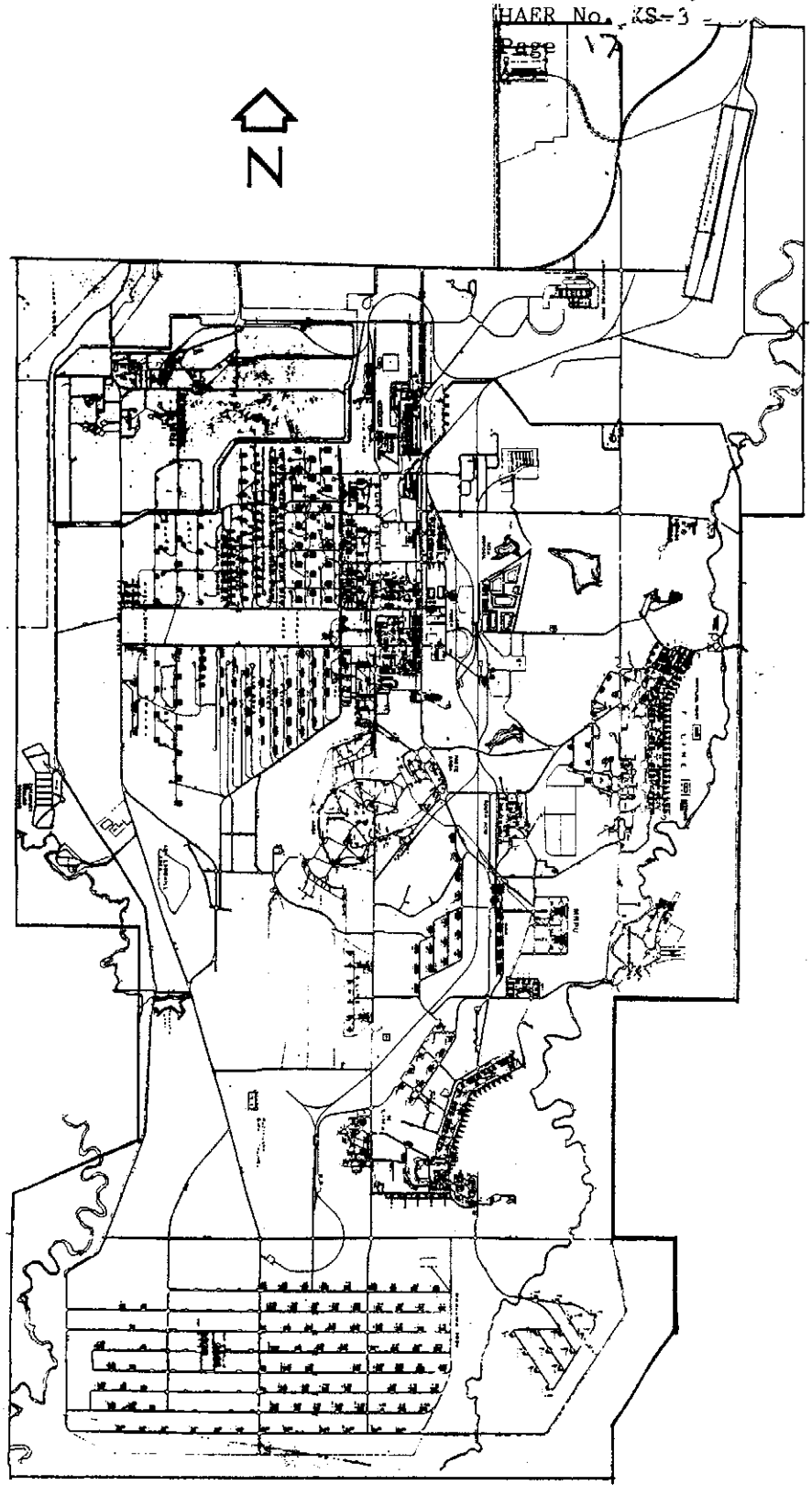

Figure 1: Sunflower Army Ammunition Plant. Current Site Plan, dated 3/31/80, prepared by Hercules, Inc. (Source: Contractor files, Sunflower AAP)

The SFAAP currently comprises about 1,200 structures. Nearly 1,000 of these date from the World War II period, but because of subsequent modifications, no original production lines remain intact.

WORLD WAR II

Although the United States constructed an extensive munitions-manufacturing network during World War I, few facilties survived the country's "return to normalcy" and disarmament of the 1920s. The dismantling of powder and explosives works was particularly thorough. By the mid-1930s, there were only four active plants for manufacturing single-base smokeless powder, which was the primary propellant for American military ammunition. Two of these installations were owned and operated by the federal government: the Army's Picatinny Arsenal in New Jersey, and the Navy's Indian Head Plant in Maryland. The other two, both located in New Jersey, were owned by private industry: the Carney's Point Plant of E.I. du Pont de Nemours & Co, Inc., and the Kenvil Plant of Hercules Powder Co., Inc. Although these facilities employed modern manufacturing techniques, their combined capacities were barely equal to the task of supplying the nation's peacetime armed forces. As a first step toward expanding American smokeless powder capability, the U.S. Ordnance Department in 1937-1938 requested Hercules and du Pont to assist in the preparation of engineering specifications for a series of new plants. At the same time, the government began stockpiling "powder machinery and specialized equipment . . . that might not be readily available in an emergency."[1] The emergency came with the fall of France in the summer of 1940, when Congress appropriated defense funds for three new powder plants.

Two more powder plants were among the 25 ordnance plants authorized in 1941, and another two, including Sunflower AAP, were among the 25 plants that began construction between January and August 1942, after the attack on Pearl Harbor.[2]

Site Selection and Former Land Use

The U.S. Navy Bureau of Ordnance, surveying over 200 potential sites for munitions plants, first tentatively selected a site near DeSoto, Kansas, the future SFAAP site, in November 1940.[3] Although that site was not among the five the Navy finally chose, it came to the attention of the Army Ordnance Department, which began a similar search in April 1941. The basic criteria for locations "suitable for construction of a TNT, DNT, Smokeless Powder Plant" included:

(1) a mid-continental location as a defense against enemy bombardment;
(2) proximity to main roads and railroad lines;
(3) availability of a suitable labor force;
(4) ample water supply for processing purposes;
(5) access to cotton, a basic raw material for smokeless powder production, and toluene, an oil-refining by-product used in high explosive manufacture;
(6) large, isolated tracts of land for safety in explosives manufacturing.[4]

The DeSoto site satisfied these criteria: it was adjacent to Kansas State Highway 10, the Atchison, Topeka & Santa Fe Railroad, and the Kansas (locally called the Kaw) River, and it was close enough to Kansas City and Lawrence to permit workers to commmute. The government purchased about 10,474 acres of relatively flat, clear and lightly wooded land, and on 26 February 1942 announced the construction of an ammunition plant.[5]

The land purchased for the plant had comprised some 150 farms and a small community called Prairie Center. Prairie Center's cemetery was moved outside the plant boundaries to the west,[6] and of the various houses, barns, and outbuildings that originally occupied the site, only one remains today (Building FH-3 / Figure 2). Overlooking Roberts Lake near the western boundary of SFAAP, Building FH-3 is the former home of a locally prominent dentist, Dr. Sam Roberts, and is officially called the Recreation Building, although it is more commonly known as the Roberts Lake House. With its massive chimneys and double-height living space, the two-story yellow sandstone house is a good example of the vigorous, rustic masonry style popular in early twentieth-century Kansas City and the surrounding area (Figure 3). Traces of its lineage can be seen in two nineteenth-century buildings in nearby DeSoto.

Construction

The SFAAP* was originally intended to produce both (propellant) smokeless

* From the time of its construction through the Korean War, SFAAP was officially known as Sunflower Ordnance Works. For the sake of clarity and brevity, this report will use the current name, Sunflower Army Ammunition Plant, the official designation since 1 August 1963.

Figure 2: Roberts House, now called Recreation Building (Building FH-3). View from the north, across Roberts Lake. (Source: Field inventory photograph, Robert Ferguson, MacDonald and Mack Partnership, 1983)

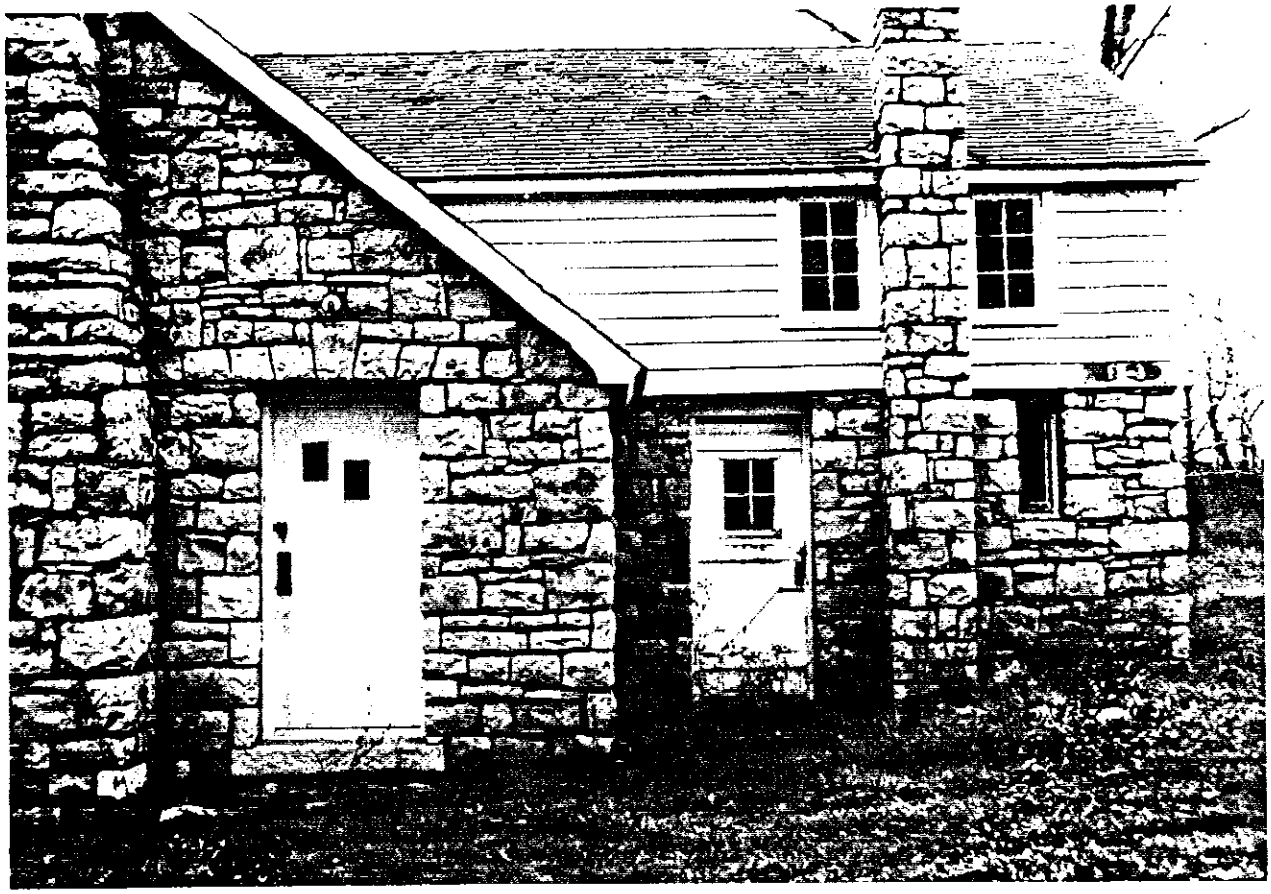

Figure 3: Roberts House. Detail of northwest elevation. (Source: Field inventory photograph, Robert Ferguson, MacDonald and Mack Partnership, 1983)

powder and the high explosive TNT. But the Ordnance Department soon revised the plans to provide facilities only for smokeless powder and nitroglycerin, an ingredient in multiple-base powders, along with the necessary acids and solvents.[7] Much of the design work for buildings and production lines had already been done, since Hercules Powder Company, the operating contractor, had been working with the Ordnance Department on the design of smokeless powder facilities since the late 1920s. Their Radford Ordnance Works in Virginia, among the first of the new plants authorized in 1940, was the first to start production, in March 1941. Experience gained at Radford went onto the design of a new and larger plant, the Badger Ordnance Works in Wisconsin. Construction of Badger had just begun when Hercules signed the contract for Sunflower AAP in May 1942.

Sunflower was to be virtually identical to Badger: the overall layout was adapted to the different site conditions, but the Hercules-designed production buildings and their arrangements in self-contained production lines were duplicated with only occasional minor changes.[8]

Architectural, engineering, and construction management (AEM) services, including design of nonproduction buildings and hiring of subcontractors, were performed by a team made up of William S. Lozier, Inc., of Rochester, New York, and Broderick & Gordon, of Denver, Colorado. William S. Lozier - Broderick & Gordon signed their contract just after Hercules, in May 1942, and construction began immediately.[9]

DeSoto historian Dot Ashlock-Longstreth gives a vivid description of her tiny village struggling to accommodate a work force that was to exceed 12,000:

> The impact of such a horde of people descending on a LITTLE town must be lived through to be understood. At one time there were eight restaurants, some operating 24 hours per day (including their juke boxes with "Pistol Packin' Mama"). Homes HAD to be opened to roomers, garages, chicken houses, out-buildings converted into living quarters, large buildings converted into bunk bed housings, trailers, unlimited tents, "anything with four walls and a roof, became rentable property", and dozens slept out in the open yards, if weather permitted, or in cars. Merchants, the bank, the postoffice, filling stations, etc., worked until the personnel were ready to drop![10]

Less than a year after construction began, on 23 March 1943, SFAAP produced its first powder. A site plan of the plant at that time (Figure 4) shows five smokeless powder lines (B, C, D, E, and G Lines); the Nitroglycerin Area, between E and G Lines; the Magazine Area; and the ancillary Acid Areas, Shop and Change House Areas, and Staff Housing and Administration Areas. The plan also shows the beginning of construction of F Line, a rocket-propellant line.

As the war progressed, technological developments in the design and production of rocket propellant allowed rockets to assume increasing strategic importance. Hercules had set up a pilot rocket propellant production line, Pilot Plant A, at Radford early in 1942. Full-scale lines based on Pilot Plant A were added to SFAAP beginning in 1943; William S. Lozier - Broderick & Gordon also handled their construction, which continued into 1945. In all, three rocket lines were built at SFAAP: F and N Lines, which were nearly identical; and O Line, located west of G

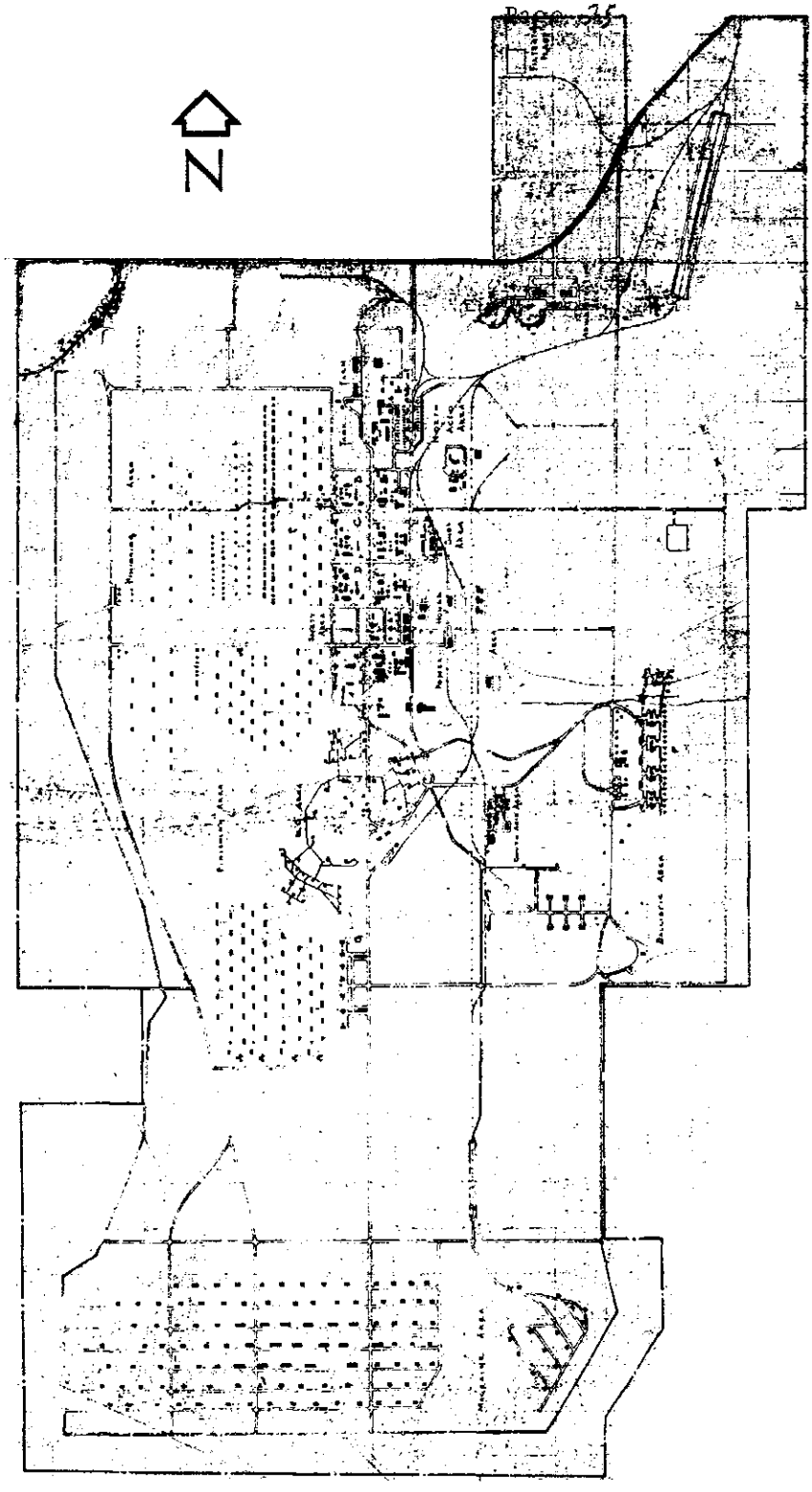

Figure 4: Sunflower Ordnance Works. Site Plan, dated 1-13-43, prepared by William S. Lozier, Inc. and Broderick & Gordon. (Source: Contractor files, Sunflower AAP)

Line and the Nitroglycerin Area, which was smaller and produced propellant for the Navy. Hercules used the experience gained on F and N Lines in adding the subsequent rocket lines to Badger AAP.[11] Also added by 1945 were the Ballistics Area and Sunflower Village, an 852-unit housing project for plant employees, directly across Kansas Highway 10 from the Administration Area.

Most of the buildings constructed during World War II were simple, utilitarian structures designed for temporary use. According to a report prepared by Hercules:

> A typical building was constructed with 8" monolithic concrete foundations. The foundation wall was carried 6" above the floor line to form a curb. The sidewalls were framed with 2"x6" wood studs, 2'-0" on center, and enclosed with novelty siding. Where spans would permit, wood rafters spaced 2'-0" on center were used in roof construction. Longer spans were constructed of light wood trusses, spaced 2'-0" on center. The roofs were sheathed with 7/8" T&G [tongue and groove] lumber covered with Class B roll roofing. The doors, windows, ventilators, etc., were of standard design and of a type that could be furnished by any mill. The interior was left unfinished, except for a rough concrete floor [Figure 5].[12]

Especially large buildings, such as the Boiling Tub and Poaching and Blending Houses (on D Line, Buildings 4019 and 4024), employed heavier mill-type construction, with wood columns and trusses on concrete foundations. Buildings where acids and finished powder were handled had special interior details, including floor coverings of lead or Hubbelite (conductive rubber) and sealed interior walls of transite or plywood impregnated with paraffin.

Figure 5: Inspection House (Building 7816-2) is typical of small-scale wood construction at SFAAP. (Source: Field inventory photograph, Robert Ferguson, MacDonald and Mack Partnership, 1983)

Buildings housing particularly hazardous production steps utilized various types of "blow-out" construction to confine or direct potential explosions. Parallel, concrete or brick barrier walls typically divided these buildings into equipment bays. Light wood-frame infill construction, designed to blow out during an explosion, directed the thrust away from the adjacent bays. Buildings constructed in this manner included the Vertical Press Houses (on D Line, Buildings 4513-1, through 4513-3 / Figure 6) and Mix Houses (Buildings 4508-1, 4508-2). Another precaution against explosion or fire spread was the enclosure of a building by earth barricades. These barricades were either free-standing, as in the Magazines (Buildings 602-1 through 607-7 / Figure 7), or supported on one or both sides by timber retaining walls (revetments). Among the many production buildings so barricaded were the Final Blend and Can Pack Houses (Buildings 1825, 1875-1 through 1875-4) on the cannon powder lines, and the Nitrating Houses (Buildings 5657-1 through 5657-3) in the Nitroglycerin Area (Figure 8).

Only the Power Houses (Buildings 154-1, 154-3) and the Nitrocellulose Nitrating Houses (e.g., Building 4012) employed steel skeleton construction; they were faced with clay tile and brick, respectively. The acid and solvent areas consisted mainly of large wood-frame structures of the type described above, in combination with networks of piping and holding tanks. An example is the Nitric Acid Concentrator (Building 703-2 / Figure 9).

Figure 6: Vertical Press House (Building 4513-3) demonstrates typical "blow-out" construction at SFAAP. (Source: Field inventory photograph, Robert Ferguson, MacDonald and Mack Partnership, 1983)

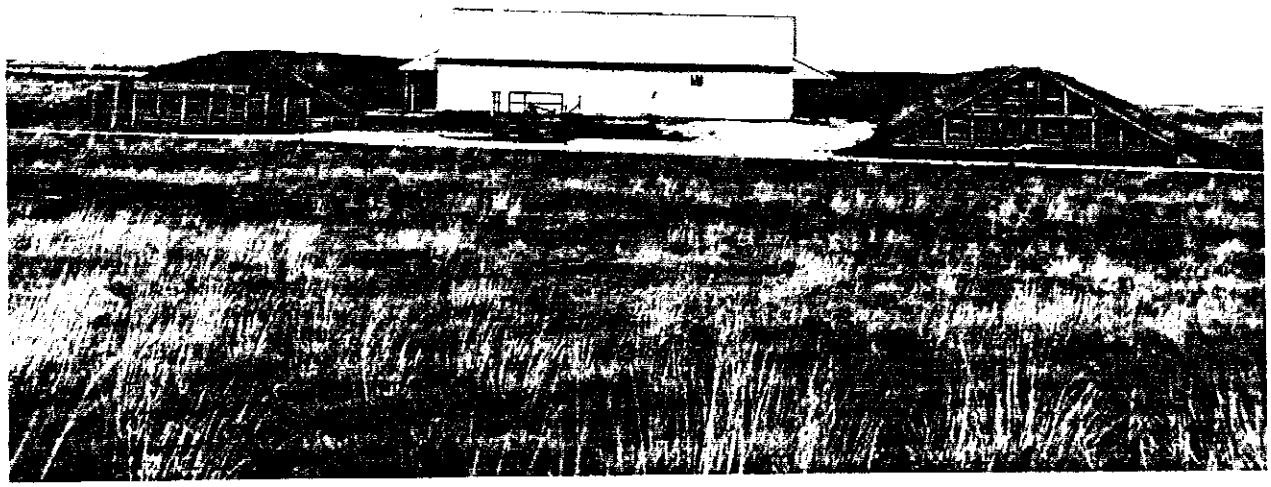

Figure 7: Magazine (Building 603-46) with earth barricades. (Source: Field inventory photograph, Robert Ferguson, MacDonald and Mack Partnership, 1983)

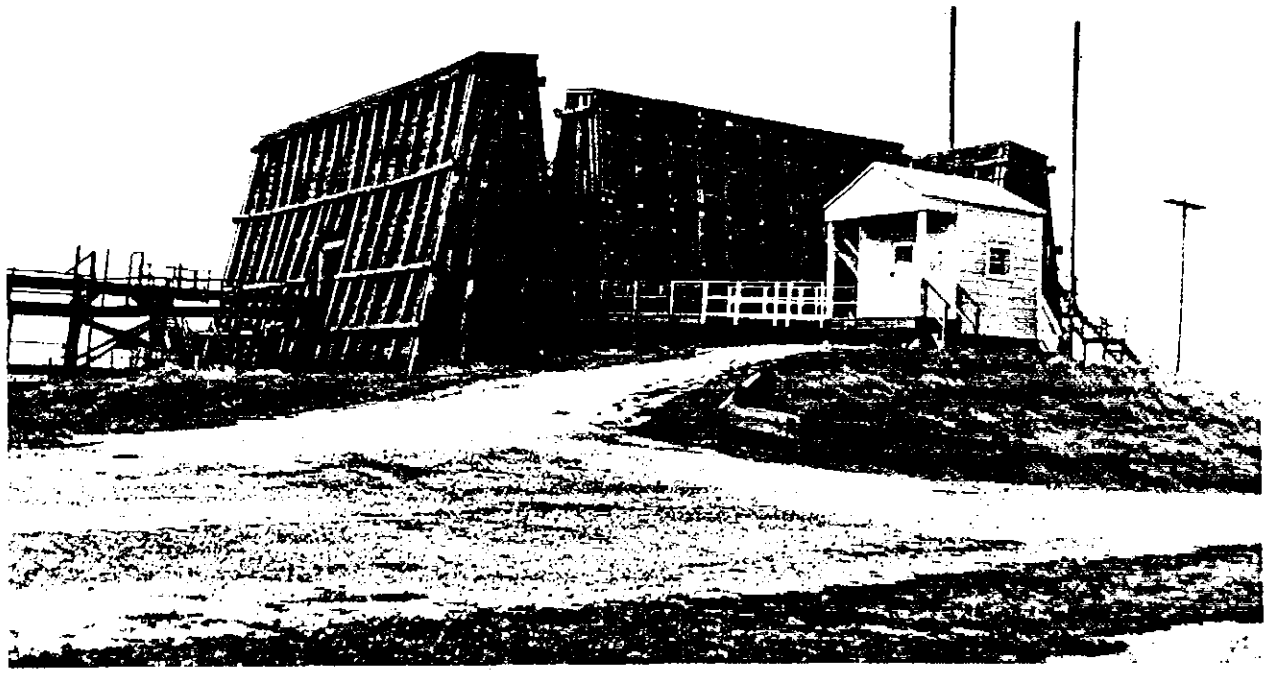

Figure 8: Nitroglycerin Nitrating House (Building 5657-2) is behind the earth-filled timber barricades. The small structure outside the barricades is a service building. (Source: Field inventory photograph, Robert Ferguson, MacDonald and Mack Partnership, 1983)

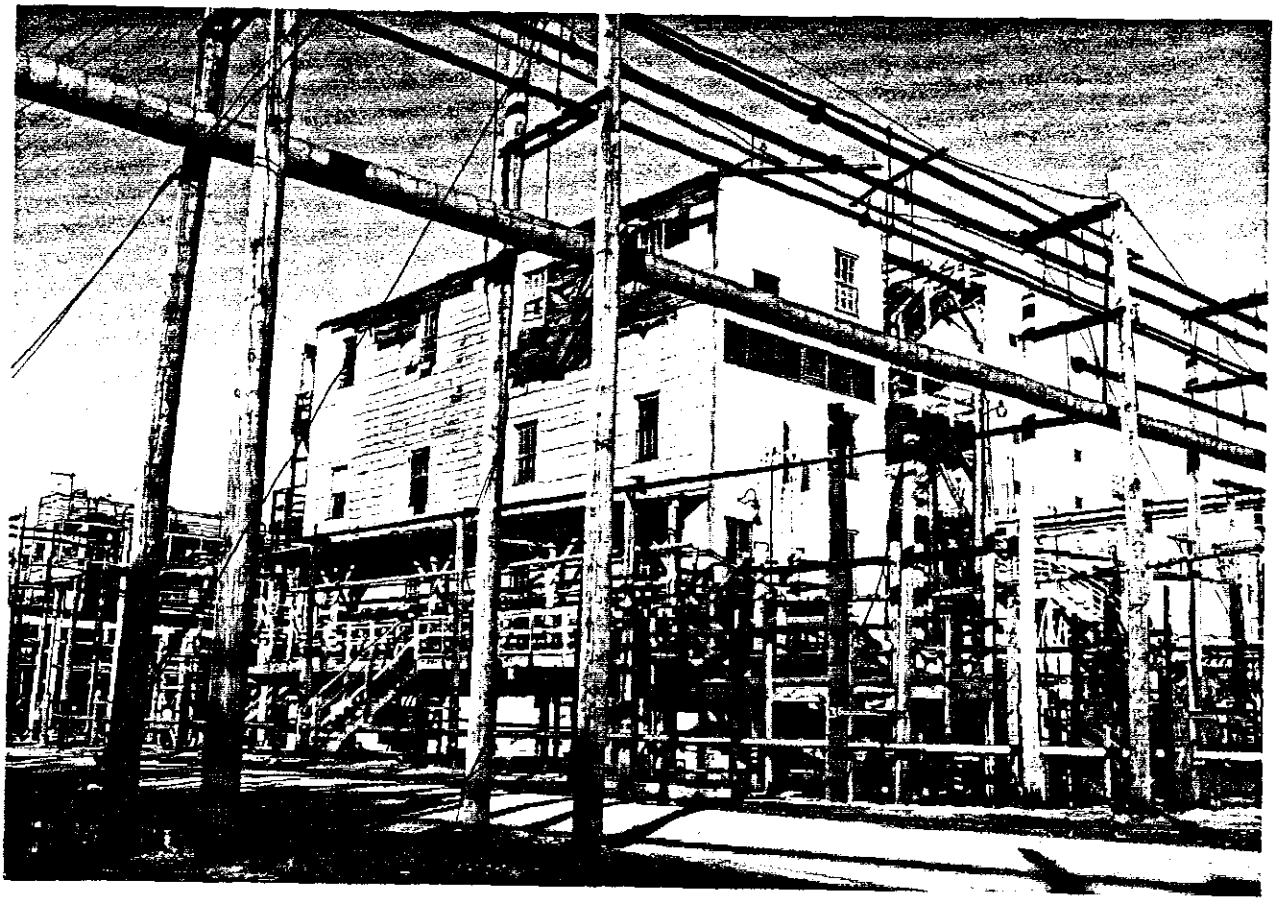

Figure 9: Nitric Acid Concentrator (Building 703-2). (Source: Field inventory photograph, Robert Ferguson, MacDonald and Mack Partnership, 1983)

Technology

The term "smokeless powder" is a double misnomer. The material is actually a granulated substance, and is considered smokeless chiefly in comparison to black powder, which it replaced as the standard military propellant during the late nineteenth-century. Smokeless powder is categorized, according to the number of its active ingredients, as single-, double-, or multiple-base. Single-base powder, adopted by the American military for cannon and small arms during both world wars, derives its propellant qualities from nitrocellulose. The modern manufacture of single-base powder still resembles the pioneering method developed by the French chemist Vielle in 1886. Vielle treated cotton with nitric acid to form nitrocellulose, gelatinized it with ether or alcohol, then dried and cut the resulting material into "grains." Subsequent improvements on Vielle's method included the perforation of powder grains to increase surface area and burning rate, and the use of chemical additives as stabilizers and flash retardants. In the summer of 1940, the Ordnance Department codified production methods for smokeless powder in a technical manual that dictated operating procedures at the SFAAP and most other World War II plants.[13]

The SFAAP's five parallel smokeless powder lines were designated (north to south) as "B", "C", "D", "E", and "G" Lines. B, C, and D Lines produced single-base powder; E and G Lines, adjoining the Nitroglycerin Area on the other side of a vacant "Safety Area," produced double- and multiple-base powders including nitroglycerin as an explosive agent. The Hercules process for producing single-base cannon and rifle propellant has been summarized as follows:

The nitration of purified cotton, the first step . * . , is accomplished [in the Nitrating House, Building 4012* / Figure 10] by adding mixed sulphuric and nitric acids to cotton linters. ["Cotton linters are the lint or fuzz remaining on cotton seeds after the cotton has been removed." The linters are received, unbaled, and dried in the Warehouse/Drying House, Building 4000.] After nitration the nitrocellulose is pumped to a centrifugal wringer . . . where as much of the excess acid as possible is extracted. It is then "drowned" in cold water and moved to the boiling tubs [Boiling Tub House, Building 4019].

The nitrocellulose is next boiled in acidulated water to break down the unwanted chemical compounds which have formed in the process. After this it is transferred to beating or cutting machines [Jordan Beaters, in the Beater House, Building 4022] where it is ground under water. This finely ground or pulped nitrocellulose is boiled in alkaline and fresh water and then given cold water washings to remove all impurities. [Poaching and Blending House, Building 4024. Water content is reduced in the Final Wringer House, Building 4026.]

At this point the nitrocellulose enters the actual "powder line." In the dehydration house [Building 4500] a charge of wet nitrocellulose is dumped into a hydraulic press and compressed into a block. Alcohol is pumped through the block in the press forcing out the water. Much higher pressure is then applied which forces out most of the alcohol.

The dehydrated nitrocellulose is sent to a block breaker, which breaks the block into small pieces. This material then goes to the mixing machine in the mix house [4508-series Buildings] where ether and alcohol and certain stabilizing chemicals are added, and the ingredients mixed until a mealy mass is formed; and this is more thoroughly mixed in the macerators. The mixed powder is then dumped into a preliminary block-forming press [in the Block and Macaroni Press Houses, 4510-series Buildings] and under pressure formed into blocks. . . . The blocks are placed in a "macaroni" press, where the powder is forced through a fine mesh screen. The material is then reblocked in a press similar to the preliminary block-forming press.

One or two blocks are put into the finishing press [Vertical Finishing Press/Cutter Houses, 4513-series Buildings], . . . pressed through dies and forced out in long spaghetti-like strings into fiber buckets. These strings have either one or

*Building numbers in this description refer to D Line, the only single-base line at SFAAP that is still substantially intact.

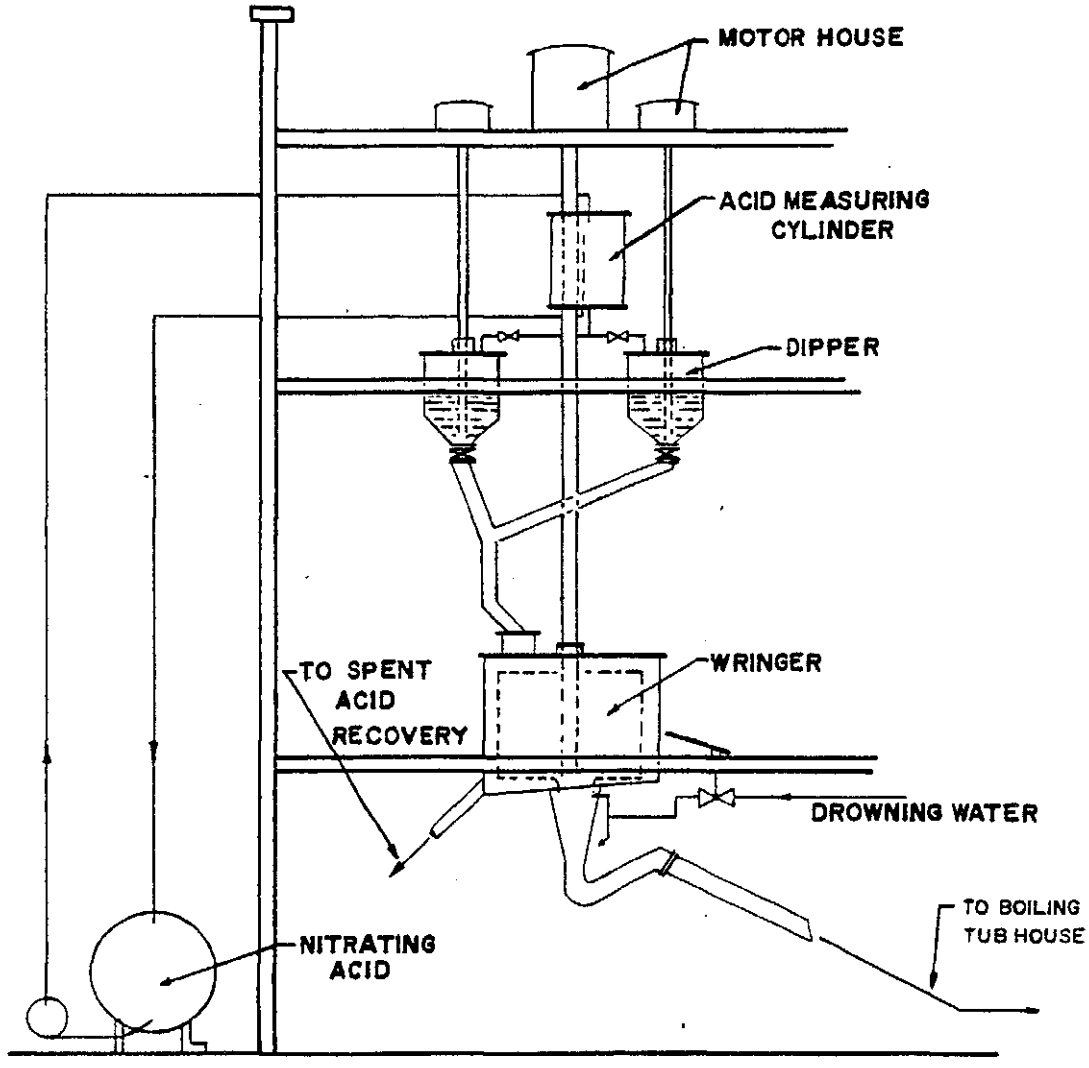

Figure 10: Diagrammatic Cross-Section of Hercules Process Nitrocellulose Nitrating House (e.g., Building 4012). (Source: Contractor files, Sunflower AAP)

> seven longitudinal holes formed by the dies. The strings are fed into cutting machines, which cut them into grains of the desired lengths. The diameter and length of the grains are varied according to the ballistic characteristics required.
>
> The powder grains are then conveyed to the solvent recovery building [1600-series Buildings] where they are treated for several days and most of the ether and alcohol recovered. As the powder still contains too much solvents [sic] for use, it is taken to the "water dry" [1650-series Buildings] where it is placed in hot water. When the solvent content has been reduced sufficiently, the powder is placed in the air dry house [1725-series Buildings] where warm air blown over and through the powder dries it further.
>
> Cannon powders require no glazing, but rifle powders are glazed with graphite to make them flow freely [Coating Houses, 1700-series Buildings, and Glaze Houses, 1800-series Buildings]. Rifle is then sieved and cannon powder sorted to remove imperfect grains. The various batches are blended [Preliminary and Final Blend Houses, 1820- and 1825-series Buildings] to obtain powder of uniform ballistics and finally packed [Can Pack Houses, 1875-series Buildings] ready for storage or shipment to loading plants.[14]

Manufacture of double-base cannon and rifle powder was similar, except that before entering the powder line, the nitrocellulose was mixed with nitroglycerin in a Premix Area located between the Nitroglycerin Area and the powder line (5620- and 5670-series Buildings). These products were dried by forced air rather than by the solvent recovery / water dry / air dry sequence.

Another variation in the procedure involved the production of nitrocellulose with materials other than cotton linters, which were often expensive and scarce. Long-staple cotton could be used, but required chopping to avoid clogging the slurry lines. The most common substitute for cotton linters was wood pulp, which, although it also required extra processing, was inexpensive and reliably available. In accordance with

advance planning by the Ordnance Department, the World War II smokeless powder plants were built with nitrocellulose lines both for cotton and for wood pulp, and usually with "swing" lines which could be adapted for either material. The three single-base lines at SFAAP originally included one cotton, one wood, and one swing line.[15]

Rocket propellant, the SFAAP's other major product during World War II, consisted of smokeless powder in very large (up to 5" diameter) grains or sticks with longitudinal perforations to achieve a uniform thickness of propellant material (web thickness) and therefore a uniform burning rate. In the early part of the war, double-base solvent powder, much like cannon powder, was used; but the size of grains that could be produced by this method, and thus the size of the rockets they were to power, was severely limited. Large grains distorted and cracked during the long drying process, and such flaws in the finished grain caused erratic burning. Ordnance engineers, therefore, began working with dry extrusion of solventless powder, a process pioneered by the British in the late 1930s. The experiments were successful, and Hercules Powder Company's Pilot Plant A at Radford was in operation by 1942. Thereafter, the demand for solventless rocket powder increased steadily, leading to the addition of F, N, and O Lines to SFAAP.[16]

The production of double-base solventless rocket powder at SFAAP began by mixing nitroglycerin and nitrocellulose, along with several inactive ingredients, in a water slurry in the Pre-Mix (Buildings 5802-1, 5802-2) and Final Mix Houses (Buildings 5804-1,5804-2) near the Nitroglycerin Area. After centrifuging and air drying (Buildings 6869-1 through 6869-16) to

reduce moisture, the resulting paste was then blended (in the Paste Blender House, Building 5803-3*) to assure homogeneity. During World War II, "Sweetie" barrels, common candy-industry equipment, were used for blending. The paste was rolled into sheets on rolling mills (Roller Houses, Buildings 5807-1 through 5807-15, 7807-1 through 7807-11), and the sheets cut to size and rolled into cylindrical "carpet rolls" (Slitting and Carpet Roll Houses, Buildings 5808-1 through 5808-5, 7808-1 through 7808-4) of proper size to fit the press that would extrude the final grain. Because of the possibility of explosion, the remote-controlled extrusion presses were located in individual, earth-sheltered concrete buildings (Press Houses, Buildings 5810-2 through 5810-25 / Figure 11) at the perimeter of the line. Other "remote" operations, in which fires were likely, included paste rolling and several milling operations in the grain-finishing process. After the pressing, workers entered the Press House, cut the long extrusion into approximately sized grains, and sent them to the Finishing Area. There, the grains were annealed (Annealing Houses, Buildings 7868-1 through 7868-4) to relieve internal stresses developed during extrusion, and sawn to exact length (Buildings 5813-1, 5813-2, later converted to other uses and renumbered). Protective caps, or "end inhibitors," were applied before the grain was machined to exact diameter and wrapped with inhibiting tape to reduce the possibility of premature ignition (Milling House, Building

*From this point on, building numbers in this discussion of the rocket propellant process will refer to F Line, the earlier and more nearly intact of the two rocket lines remaining in 1983. During the most recent operation of SFAAP (Vietnam War), the production steps up through extrusion were performed on F Line, steps from annealing through packout on N Line. In the 1950s, Building 5803-3 was converted to a Rest House, and other Blender Houses were demolished, due to a change in the technology of this step. See the discussion under "Korean War" below.

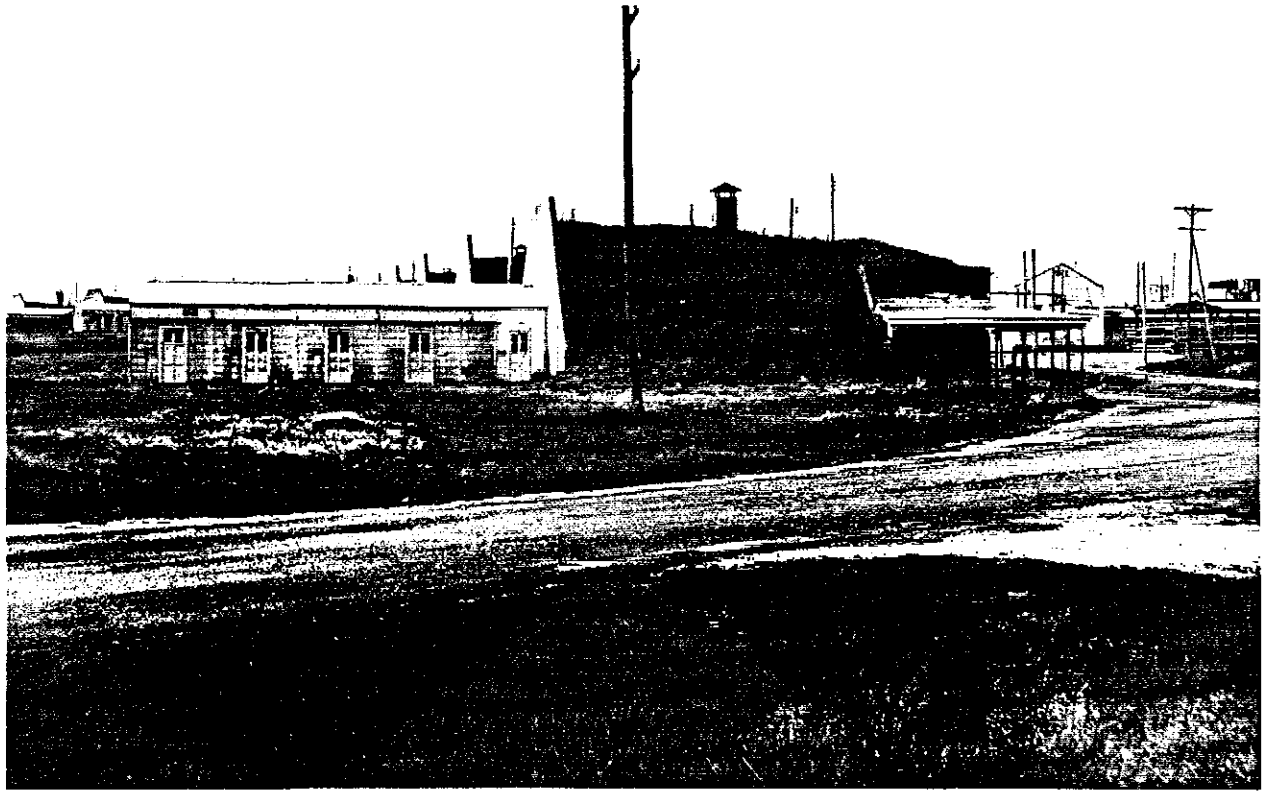

Figure 11: Extrusion Press House (Building 5810-1), F Line. (Source: Field inventory photograph, Robert Ferguson, MacDonald and Mack Partnership, 1983)

7814, later called Dowel and Multi-Wrap House; Milling and Inspection House, Building 7894). The final inspection performed at this point was the culmination of a series of inspections at critical points throughout the process (Figure 5).[17]

In addition to manufacturing finished propellant, the SFAAP also produced nitroglycerin for use with nitrocellulose in double- and multiple-base powders; ether, used with alcohol in solvent powders; and nitric and sulfuric acids for production of nitrocellulose and nitroglycerin. The acid-production facilities were conventional; by 1983 most had been demolished and the remainder substantially altered.

Following V-J Day, the Army reduced powder production schedules at SFAAP, but did not officially place the plant in "standby" status until 1948. Hercules Powder Company continued as operating contractor until that time, producing ammonium nitrate liquor for use in making fertilizer for the government's foreign-aid program. In June 1948, Hercules turned the SFAAP over to the Ordnance Corps and vacated the plant.[18]

KOREAN WAR

The government reactivated SFAAP in early 1951. Hercules Powder Company returned to its World War II role as operating contractor, and the Massman-Patti-Tanner and Mitchell Construction Company provided AEM services for rehabilitation and new construction, which lasted until May 1955.[19] During this period, the SFAAP produced double-base cannon and rifle and triple-base cannon powder, and several types of rocket propellant grains.[20]

An important development at SFAAP during the Korean War period was the invention of the "Sunflower Blender." The disadvantages of the Sweetie Barrels used for blending solventless rocket propellant paste (they were slow, dangerous, and space-consuming) had led to a search for an alternative. According to veterans of the period, Chief Project Engineer Merle Siegmund, considering the problem while driving to work, found himself behind a cement mixer and decided to apply that technology to his needs. The Sunflower Blender (Figure 12), which Siegmund designed in 1953, incorporated the cement mixer's revolving barrel and its interior fins for mixing and scraping the sides of the barrel. The prototype, made of aluminum, developed fractures, and stainless steel was used thereafter. Fulfilling their intended purpose, Sunflower Blenders replaced Sweetie Barrels at SFAAP, where new buildings to accommodate the new blenders were constructed in 1955 (Buildings 7825 and 7829; Building 7825 was destroyed by fire in 1970). The Sunflower Blender was also adopted by other smokeless powder plants.[21]

The Army did not deactivate SFAAP immediately after the Korean War. Production continued until 1957, and experiments and testing continued until June 1960.[22] One subject of these experiments was mechanization of the process of rolling rocket propellant paste into sheets. As previously performed on differential and evenspeed rolling mills, this process had been a particularly labor-intensive and hazardous part of rocket propellant manufacture. In the early 1950s, Hercules engineers began to explore ways to automate the process; equipment prototypes were tested at SFAAP by 1956, and the Pilot Mechanized Roll Plant (Building 7884) north of F Line began production in 1958 (Figure 13). A 1966 plant news release explained its operation:

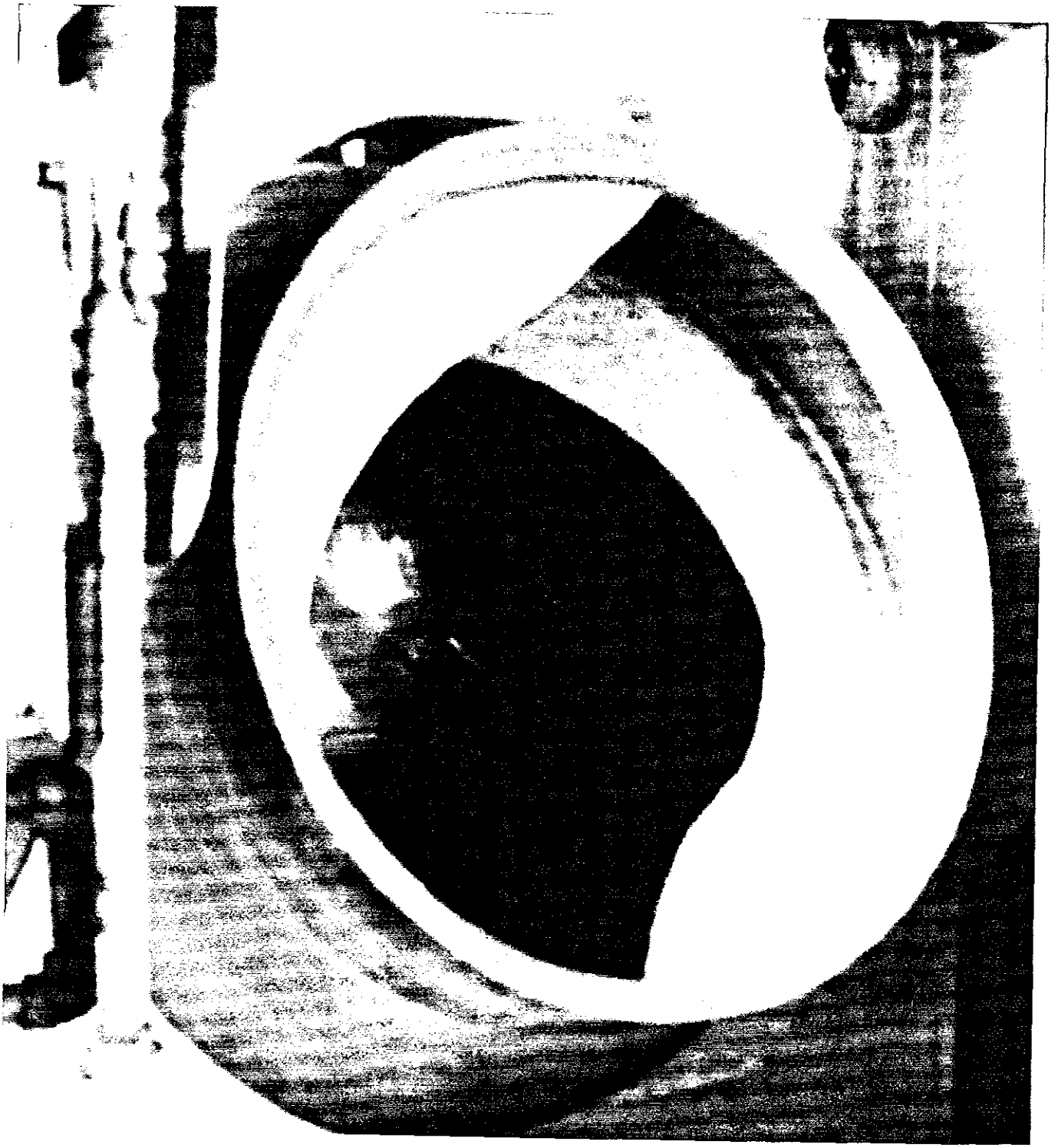

Figure 12: The Sunflower Blender. (Source: U.S. Army photograph, Sunflower AAP)

Figure 13: Pilot Mechanized Roll Plant (Building 7884). (Source: Field inventory photograph, Robert Ferguson, MacDonald and Mack Partnership, 1983)

As the name (Mechanized) implies, the operation is almost completely automatic. The equipment is operated from the control room, the nerve center where an electric control panel activates each step, and where closed circuit television cameras monitor each phase of production.

The production begins in the service room where paste is emptied into a hopper. Once inside, the paste is weighed automatically and discharged onto a conveyor belt which carries it through a metal detector and then on into a dielectric heater for preheating to 140 degrees. The conveyor carries the paste into the hopper which carries it to the pre-roll. Here it is cooked and colloided into a plastic sheet. This sheet is conveyed to the final roll where it is cut into a continuous strip four and three-fourths inches wide. The excess powder automatically goes back into the final roll in a continuous working operation.

The rolled strip is fed into a cooling tank where it travels through water for cooling. This is accomplished by threading the powder in a method similar to a movie projector. The strip is then dried by rubber wipers and a warm air jet and continues on to the carpet roll winding machine. After a roll reaches the required fifteen inch size, the machine ejects it and pushes it through a door to the loading room where it is tied by hand and loaded in a buggy to be shipped to the Press Area.[23]

After the Korean War, the Corps of Engineers sold Sunflower Village, the plant housing project, to private buyers. This has been the only major change in the plant boundaries since World War II; another small tract of land was transferred to Headquarters, 1st Infantry Division (M), Fort Riley, Kansas, in 1960. Hercules began putting the SFAAP's buildings and equipment into layaway in 1958 and finished the process in 1960. From that time until 1965, the only active production facility was the Acid Area, operated by U.S. Industrial Chemical Co. of New York to produce sulfuric acid.[24]

VIETNAM WAR TO THE PRESENT

On 20 August 1965 the Army reactivated the SFAAP to produce propellant grains for the 2.75" Folding Fin Air Rocket, for air-to-ground use in Vietnam. Known upon its introduction in 1952 as the "Mighty Mouse," this light and versatile rocket could carry any of several types of warheads and could be fired singly or in groups from small airplanes or helicopters. The propellant grain for this rocket was similar in design and production to those formerly produced at SFAAP. Hercules used D Line, which had been maintained at a higher level than the other lines, to make nitrocellulose, and rehabilitated the South Acid Area, the Nitroglycerin Area, and F and N Rocket Lines for the new operation.[25] No major new oonstruction took place at this time.

In 1965 Hercules and the Corps of Engineers began work to install a system for continuous nitration of nitroglycerin at SFAAP. The Corps accepted a construction bid in 1969, and the Continuous Nitrator (Building 5662) was complete by 1971 (Figure 14). The equipment used was the Swiss-made "Biazzi" system, common in the industry since the early 1950s. Like the Mechanized Roll facility, this installation represented the replacement of a labor-intensive "batch" process with an automated "continuous" one. While production capacity was only slightly higher than that of the batch process, fewer workers were exposed to dangerous materials, and the possibility of operator error, a particular hazard of the batch process, was greatly reduced.[26]

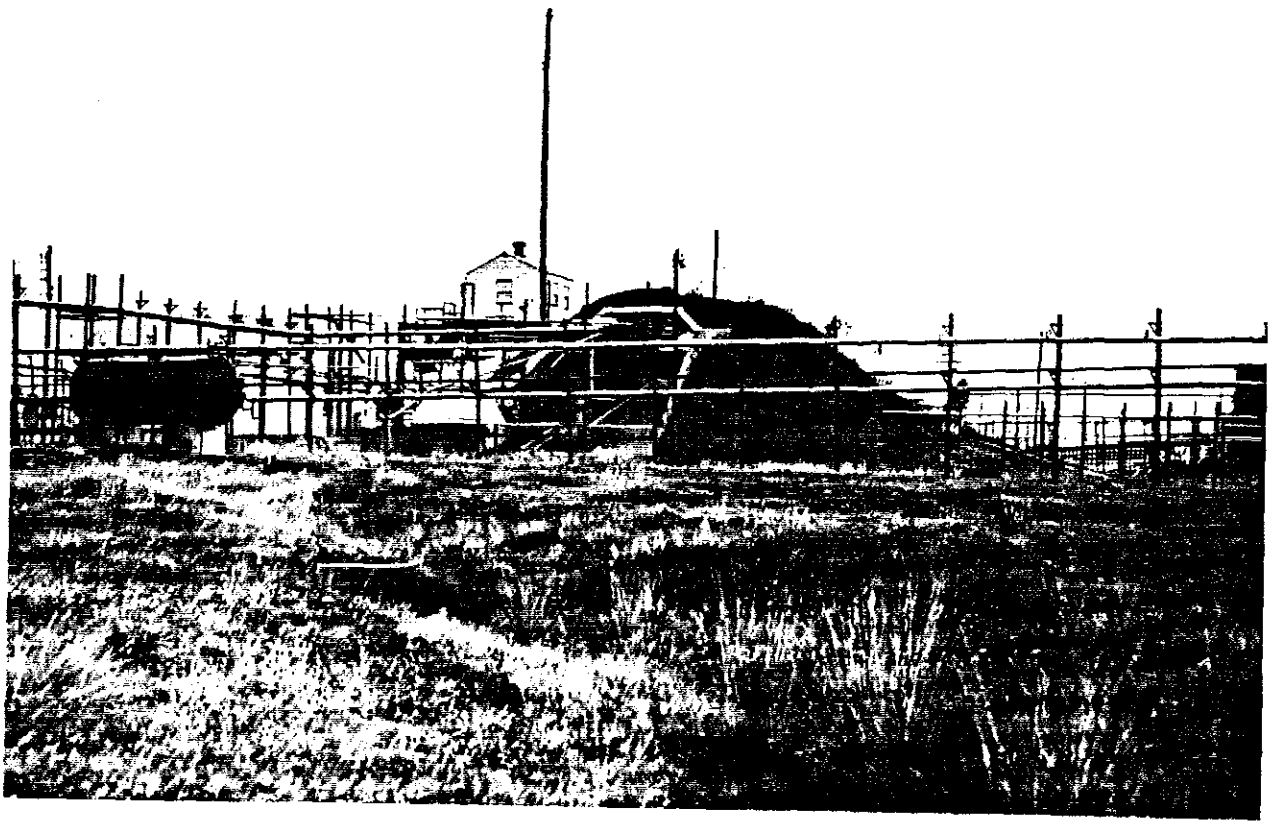

Figure 14: Nitroglycerin Continuous Nitrating House (Building 5662), containing Biazzi Unit. (Source: Field inventory photograph, Robert Ferguson, MacDonald and Mack Partnership, 1983)

Active production of rocket propellant ended in June 1971, but the SFAAP, although deactivated, entered a new period of expansion and modernization. Hercules (called Hercules, Inc., since 1 May 1966) continued to serve as operating contractor, as they do today. Major projects during the 1970s included continuous paste facilities (Buildings 9801, 9802, 9824), completed in 1976 in the Nitroglycerin Area; a Nitric Acid Concentrator/Sulfuric Acid Concentrator (NAC/SAC, Building 903-1), completed in 1977; and a Sulfuric Acid Recovery Unit (SAR, Building 729), completed in 1979. Second-generation Mechanized Roll facilities (Buildings 9807-1, 9807-2), located between F and N Lines, were completed in 1977.[27]

The most recent large construction at SFAAP is the Nitroguanidine Plant, completed in 1983. Nitroguanidine, the third active ingredient (with nitrocellulose and nitroglycerin) in triple-base cannon powder, is used to reduce flash and therefore prolong gun-barrel life.[28] When the Canadian plant that had been the Army's sole source for nitroguanidine was closed in 1975, the Army began construction of its own facility. The prime contractor, through the Corps of Engineers, was Hensel Phelps Constructors of Greely, Colorado.[29] Two buildings (Buildings 2000, 2012) on the former Nitrocellulose B Line were remodelled as a pilot plant to test the process. The main Nitroguanidine Plant consists of some 30 buildings (major production buildings include Buildings G0000, G0010, G0040, G0050, G2000, G2020, G2500, G2700, G2720, G6900, and GS300), and occupies the northwest corner of the SFAAP, near the old Staff Housing Area, most of which had been cleared by 1968. Using the British Acquafusion Process, the plant is the only facility of its kind in the United States.[30]

NOTES

1. Sidney D. Kirkpatrick, "Mid-West Builds Biggest U. S. Powder Plant," Chemical & Metallurgical Engineering, 48 (Apr. 1941), 74. The dismantling of the American munitions industry after World War I is discussed in Jules Bebie, "Making Explosives for World War II," Chemical & Metallurgical Engineering, 48 (Oct. 1941), 76. As Secretary of War Henry L. Stimson noted in 1943, "We didn't have enough powder in the whole United States [in 1940] to last the men we now have overseas for anything like a day's fighting"; see Harry C. Thomson and Lida Mayo, The Ordnance Department: Procurement and Supply (Washington, D.C.: Office of the Chief of Military History, Department of the Army, 1960), p. 104.

2. Thomson and Mayo, pp. 110-111.

3. Buford Rowland and William B. Boyd, U.S. Navy Bureau of Ordnance in World War II (Washington, D.C.: Bureau of Ordnance, Department of the Navy, n.d.), p. 5; "Basic Unit History of Sunflower Army Ammunition Plant" (unpublished report prepared by Hercules, Inc., 1967), p. 1.

4. Lenore Fine and Jesse A. Remington, The Corps of Engineers: Construction in the United States (Washington, D.C.: Office of the Chief of Military History, United States Army, 1972), pp. 134-137; Thomson and Mayo, pp. 108-110.

5. "Basic Unit History," p. 2.

6. Dot Ashlock-Longstreth, DeSoto, Kansas Is 100 Years Old (DeSoto, Kansas, 1957), p. 61. The moving of the cemetery was related by Leo West of Hercules, Inc., during an interview on 23 November 1983.

7. William Voight, Jr., "The Ordnance Organization in World War II" (unpublished report, ca. 1945, on microfiche in AMCCOM Historical Office, Rock Island Arsenal), p.294.

8. Relations between Hercules and the Ordnance Department, and the design of Radford, Badger and Sunflower Ordnance Works, are discussed in "Report of Badger Ordnance Works: World War II," (unpublished report prepared by Hercules Powder Co., 1945), pp. 12-31, 50-54, 150-153.

9. "Basic Unit History," p. 3. The AEM form of contracting, frequently used on such large jobs as munitions plants, is discussed in Fine and Remington, pp. 566-569.

10. Ashlock-Longstreth, p. 62.

11. "Report of Badger Ordnance Works," p. 54. On the development and increasing importance of rockets, see Thomson and Mayo, pp.

137-138; and Constance M. Green, Harry C. Thomson, and Peter C. Roots, The Ordnance Department: Planning Munitions for War (Washington, D.C.: Office of the Chief of Military History, Department of the Army, 1955), pp. 353-361.

12. "Report of Badger Ordnance Works," pp. 52-53.

13. Military Explosives (Technical Manual No. 9-2900, prepared under direction of the Chief of Ordnance, Washington, D.C.: War Department, August 29, 1940), pp. 4-38. On the history of smokeless powder manufacture, see also Robert G. Skerret, "Smokeless Powder for Our Navy," Compressed Air Magazine, 50 (Feb. 1945), 39-45.

14. "Making Smokeless Powder at Radford, Va.," Chemical & Metallurgical Engineering, 48 (April 1941), 103.

15. Captain J. W. LeMaistre, "Historical Report of the Smokeless Powder Unit" (unpublished report, prepared for Office of the Field Director of Ammunition Plants, St. Louis, Missouri, 1 September 1945), pp. 39-41. See also Thomson and Mayo, pp. 136-138.

16. Thomson and Mayo, pp. 137-138. On the nature and design of rocket propellant grains, see "Fundamentals of Explosives Manufacturing: History of Explosives and Propellants: History of Hercules, Incorporated: History of Sunflower Army Ammunition Plant" (unpublished document prepared by Hercules, Inc., SFAAP, September 1968), Section B (Explosives and Propellants), pp. 60-B - 70-B.

17. This discussion of the rocket powder production process is based on Henry N. Marsh, "The Development and Production of Rocket Propellants in World War II" (Chemical Industries 57, July, 1945, 65-69); "Fundamentals," Section C ("Propellant Production at Sunflower Army Ammunition Plant"); and Master Plan (unpublished report prepared by Hercules, Inc., 1 September 1978) Vol. IV: "Production Flows." Many of the buildings at SFAAP have changed function, name, and number, in some cases several times. An attempt can be made to trace these changes through Master Plan, Vol. I: "Analysis of Existing Facilities / Environmental Assessment Report;" Vol. IV; and Industrial Facilities Inventory, Sunflower Ordnance Works, DeSoto, Kansas (unpublished report prepared for the Corps of Engineers, n.d. [1945?]), but inconsistencies and lacunae are commonplace. The confusion is compounded by the fact that Master Plan and the Army's Real Property Inventory (unpublished computer printout, 31 March 82) use different building numbering systems, both different from the system currently in use at SFAAP and in all other documents.

18. "Basic Unit History," pp. 7-11.

19. "Basic Unit History," pp. 11-14.

20. "Sunflower Army Ammunition Plant, Solid Propellants Capabilities" (unpublished report prepared by Hercules, Inc., 1965, revised 1970 and 1982), pp. 11-12.

21. Information on the Sunflower Blender was gained in an interview with Shelby Chism and Leo West, of Hercules, Inc., on 23 November 1983. "Fundamentals" also describes the Blender on pp. 43-C and 44-C.

22. "Basic Unit History," p. 15.

23. "Mechanized Roll A Sunflower Exclusive," The Sunflower Planet, 1 September 1966, reproduced in "Basic Unit History," pp. 16-17.

24. "Basic Unit History," pp. 17-20.

25. "Basic Unit History," pp. 20-22.

26. Contracting for the construction of the Continuous Nitrator is discussed in "CY 1968 Supplement to Basic Unit History of Sunflower Army Ammunition Plant,"p. 11; "Second Supplement to Basic Unit History of Sunflower Army Ammunition Plant," p. 14; and "Third Supplement to Basic Unit History of Sunflower Army Ammmunition Plant," p. 27 (unpublished reports prepared by Hercules, Inc.). An extensive pictorial description of the Continuous Nitrator, including the Biazzi Unit, appears in "Fourth Supplement to Basic Unit History of Sunflower Army Ammunition Plant" (unpublished report preapred by Hercules, Inc., F.Y.1971), pp. 25-36. The completion of the construction is discussed on pp. 22-23.

27. This development is presented in narrative form in "Solid Propellants Capabilities," pp. 9-10. Building numbers and dates are found in Master Plan.

28. Green, Thomson, and Roots, p. 351.

29. Bob Fisher, "New Plant is unique in U.S.," Johnson County Sunflower, Oct. 17, 1975; Darryl W. Levings and Joe Lastelic, "Plant Readied for Wars That May Never Be," The Kansas City Star, Sunday, December 28, 1975.

30. Information on the Nitroguanidine Plant since the beginning of construction was obtained from "Solid Propellants Capabilities," p. 10; and from Henry Graziul of the Government staff and Larry Green of the Hercules staff at SFAAP during November 1983.

Chapter 3

PRESERVATION RECOMMENDATIONS

BACKGROUND

Army Regulation 420-40 requires that an historic preservation plan be developed as an integral part of each installation's planning and long-range maintenance and development scheduling.[1] The purpose of such a program is to:

- Preserve historic properties to reflect the Army's role in history and its continuing concern for the protection of the nation's heritage.
- Implement historic preservation projects as an integral part of the installation's maintenance and construction programs.
- Find adaptive uses for historic properties in order to maintain them as actively used facilities on the installation.
- Eliminate damage or destruction due to improper maintenance, repair, or use that may alter or destroy the significant elements of any property.
- Enhance the most historically significant areas of the installation through appropriate landscaping and conservation.

To meet these overall preservation objectives, the general preservation recommendations set forth below have been developed:

Category I Historic Properties

All Category I historic properties not currently listed on or nominated to the National Register of Historic Places are assumed to be eligible for

nomination regardless of age. The following general preservation recommendations apply to these properties:

a) Each Category I historic property should be treated as if it were on the National Register, whether listed or not. Properties not currently listed should be nominated. Category I historic properties should not be altered or demolished. All work on such properties shall be performed in accordance with Sections 106 and 110(f) of the National Historic Preservation Act as amended in 1980, and the regulations of the Advisory Council for Historic Preservation (ACHP) as outlined in the "Protection of Historic and Cultural Properties" (36 CFR 800).

b) An individual preservation plan should be developed and put into effect for each Category I historic property. This plan should delineate the appropriate restoration or preservation program to be carried out for the property. It should include a maintenance and repair schedule and estimated initial and annual costs. The preservation plan should be approved by the State Historic Preservation Officer and the Advisory Council in accordance with the above-referenced ACHP regulation. Until the historic preservation plan is put into effect, Category I historic properties should be maintained in accordance with the recommended approaches of the

Secretary of Interior's Standards for Rehabilitation and Revised Guidelines for Rehabilitating Historic Buildings[2] and in consultation with the State Historic Preservation Officer.

c) Each Category I historic property should be documented in accordance with Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) Documentation Level II, and the documentation submitted for inclusion in the HABS/HAER collections in the Library of Congress.[3] When no adequate architectural drawings exist for a Category I historic property, it should be documented in accordance with Documentation Level I of these standards. In cases where standard measured drawings are unable to record significant features of a property or technological process, interpretive drawings also should be prepared.

Category II Historic Properties

All Category II historic properties not currently listed on or nominated to the National Register of Historic Places are assumed to be eligible for nomination regardless of age. The following general preservation recommendations apply to these properties:

a) Each Category II historic property should be treated as if it were on the National Register, whether listed or not. Properties not currently listed should be nominated. Category II historic properties should not be altered or

demolished. All work on such properties shall be performed in accordance with Sections 106 and 110(f) of the National Historic Preservation Act as amended in 1980, and the regulations of the Advisory Council for Historic Preservation (ACHP) as outlined in the "Protection of Historic and Cultural Properties" (36 CFR 800).

b) An individual preservation plan should be developed and put into effect for each Category II historic property. This plan should delineate the appropriate preservation or rehabilitation program to be carried out for the property or for those parts of the property which contribute to its historical, architectural, or technological importance. It should include a maintenance and repair schedule and estimated initial and annual costs. The preservation plan should be approved by the State Historic Preservation Officer and the Advisory Council in accordance with the above-referenced ACHP regulations. Until the historic preservation plan is put into effect, Category II historic properties should be maintained in accordance with the recommended approaches in the Secretary of the Interior's Standards for Rehabilitation and Revised Guidelines for Rehabilitating Historic Buildings[4] and in consultation with the State Historic Preservation Officer.

c) Each Category II historic property should be documented in accordance with Historic American Buildings Survey/Historic

American Engineering Record (HABS/HAER) Documentation Level II, and the documentation submitted for inclusion in the HABS/HAER collections in the Library of Congress.[5]

Category III Historic Properties

The following preservation recommendations apply to Category III historic properties:

a) Category III historic properties listed on or eligible for nomination to the National Register as part of a district or thematic group should be treated in accordance with Sections 106 and 110(f) of the National Historic Preservation Act as amended in 1980, and the regulations of the Advisory Council for Historic Preservation as outlined in the "Protection of Historic and Cultural Properties" (36 CFR 800). Such properties should not be demolished and their facades, or those parts of the property that contribute to the historical landscape, should be protected from major modifications. Preservation plans should be developed for groupings of Category III historic properties within a district or thematic group. The scope of these plans should be limited to those parts of each property that contribute to the district or group's importance. Until such plans are put into effect, these properties should be maintained in accordance with the recommended approaches in the Secretary of the Interior's Standards for Rehabilitation and Revised

Guidelines for Rehabilitating Historic Buildings[6] and in consultation with the State Historic Preservation Officer.

b) Category III historic properties not listed on or eligible for nomination to the National Register as part of a district or thematic group should receive routine maintenance. Such properties should not be demolished, and their facades, or those parts of the property that contribute to the historical landscape, should be protected from modification. If the properties are unoccupied, they should, as a minimum, be maintained in stable condition and prevented from deteriorating.

HABS/HAER Documentation Level IV has been completed for all Category III historic properties, and no additional documentation is required as long as they are not endangered. Category III historic properties that are endangered for operational or other reasons should be documented in accordance with HABS/HAER Documentation Level III, and submitted for inclusion in the HABS/HAER collections in the Library of Congress.[7] Similar structures need only be documented once.

CATEGORY I HISTORIC PROPERTIES

There are no Category I historic properties at the SFAAP.

CATEGORY II HISTORIC PROPERTIES

There are no Category II historic properties at the SFAAP.

CATEGORY III HISTORIC PROPERTIES

Roberts House (Recreation Building, Building FH-3)

- Background and significance. Overlooking Roberts Lake near the west boundary of SFAAP, the former home of locally prominent dentist Dr. Sam Roberts is the only surviving building that pre-dates military use of the site. The two-story, yellow sandstone and wood-frame house, with its massive chimneys and balconied double-height living space, exhibits the vigorous, rustic masonry style popular in early twentieth-century Kansas City and the surrounding area, and is apparently unaltered. (See Chapter 2, Pre-military Land Use, and Figures 2 and 3.) The Roberts House (Recreation Building) is a Category III historic property because it is important as a local architectural landmark and because it is a good example of an intact country house built in a regional variant of the arts and crafts tradition of the early twentieth century.

- Condition and potential adverse impacts. The Roberts House is in fair physical condition, but is not currently in use and receives no routine maintenance. There are no plans to alter or demolish it.

Preservation options. The Roberts House should be routinely maintained and all original features should be kept intact. When mortar repairs are made, the original mortar should be duplicated in strength, color, composition, and texture. Mortar joints should be duplicated in width and joint profile. Stonework repairs should be made with like materials. Similarly, deteriorated woodwork should be repaired rather than replaced, if possible; and necessary replacement should be done in kind. Interior woodwork should remain unpainted. Painted exterior wood surfaces should be kept painted; if paint removal is necessary to facilitate repainting, it should be done by hand-scraping and sanding. Destructive paint-removal methods such as propane or butane torches and sandblasting should be avoided. See the general preservation recommendations at the beginning of this chapter for Category III historic properties not listed on the National Register.

NOTES

1. Army Regulation 420-40, Historic Preservation (Headquarters, U.S. Army: Washington, D.C., 15 April 1984).
2. National Park Service, Secretary of Interior's Standards for Rehabilitation and Revised Guidelines for Rehabilitating Historic Buildings, 1983 (Washington, D.C.: Preservation Assistance Division, National Park Service, 1983).
3. National Park Service, "Archeology and Historic Preservation; Secretary of the Interior's Standards and Guidelines," Federal Register, Part IV, 28 September 1983, pp. 44730-44734.
4. National Park Service, Secretary of the Interior's Standards.
5. National Park Service, "Archeology and Historic Preservation."
6. National Park Service, Secretary of the Interior's Standards.
7. National Park Service, "Archeology and Historic Preservation."

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APPENDIX A

DEPARTMENT OF THE ARMY
SUNFLOWER ARMY AMMUNITION PLANT
PO BOX 640
DESOTO, KANSAS 66018

H. Graziul/njp/791-6813

April 23, 1984

REPLY TO
ATTENTION OF:

SMCSU

MacDonald and Mack Partnership
215 Grain Exchange Building
Minneapolis, Minnesota, 55415

Dear Sir:

Due to proprietary considerations relative to the design of various parts of the nitroguanidine manufacturing facility, held by Hercules Incorporated, operating contractor of Sunflower Army Ammunition Plant, photographs of the nitroguanidine area were disallowed.

Sincerely,

Thomas G. Stutz

Thomas G. Stutz
Commander's Representative